

## **REMARKS**

Favorable reconsideration and allowance of this application are requested.

### **1. Applicants Interview Summary**

The Applicants' undersigned attorney wishes to express his appreciation for the courtesies and time extended by Examiners Cutliff and Keys during the personal interview of March 18, 2010.<sup>1</sup> It is believed that the discussions had during the interview materially advanced prosecution of this application.

The discussions during the March 18<sup>th</sup> interview focused predominantly on the Drent 3 (USP 6,737,542) and the Drent 2 (USP 5,304,674) references of record. Especially with respect to Drent 2, it was pointed out that, even though "mixtures" of catalysts were proposed therein, the actual teaching of such reference publication is that the mixture is necessary in order to selectively achieve diesters as a result of the carbonylation of butadiene. If one skilled in the art wished to make selectively the monoester then Drent 2 would instruct not to employ a catalyst mixture at all in light of the data provided by Comparative Example A thereof. Moreover, it was noted that neither Drent 2 nor Drent 3 disclose or suggest at all anything about the stability of the catalyst systems. Thus, combining these references along with the other reference publications of record would not achieve the invention as presently claimed.

### **2. Discussion of Claim Amendments**

Independent claim 1 has been revised further so as to clarify that process is directed toward the production of alkylpentenoate by carbonylation of 1,3-butadiene by reacting 1,3-butadiene with carbon monoxide and a hydroxyl group-containing compound in the presence of a palladium catalyst system in a reaction zone to produce a reaction mixture comprised of an alkylpentenoate reaction product. Support for the

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<sup>1</sup> Examiner Keys was a participant via telephone link.

carbonylation of a butadiene to obtain an alkylpentenoate reaction product can be found throughout the specification as originally filed, for example, at page 15, lines 27-29 (*"The process according to the present invention is particularly suitable for the production of alkylpentenoates...by carbonylating 1,3-butadiene in the presence of an appropriate hydroxyl group-containing compound."*) Claim 18 has been canceled as redundant.

In addition, independent claim 1 has been amended so as to clarify that the claimed process produces a reaction mixture with a selectivity to alkylpentenoate reaction product of 87% and higher. Support for such high selectivity to the alkylpentenoate reaction product can be found in the Examples, e.g., at page 23, lines 5-6 and lines 30-31 and page 26, line 6.

Claims 2 and 6-8 have been amended so as to clarify that each of the process ligand (b) as ligand make-up and the second phosphine ligand as ligand make-up is added to the mixtures.

Claim 22 is new and requires the butadiene the resulting carbonylation product is "methyl pentenoate". Support for new claim 22 can be found in the specification passage noted immediately above, as well as the Examples, e.g., Example 1 on page 22, lines 1-3 and page 23, line 5, Example 2 on page 23 line 31 and Example 3 on page 26, line 6.

Therefore, following entry of this amendment claims 1-9, 12-15 and 17, and 19-22 will remain pending herein for which favorable action on the merits is solicited.

### **3. Response to 35 USC §112 Rejection**

The amendments to claims 2 and 6-8 above are believed to address completely the rejection advanced thereagainst under 35 USC §112, second paragraph. As such, withdrawal of the rejection advanced against such claims under 35 USC §112, second paragraph is in order.

#### 4. Response to 35 USC §103(a) Rejection

The Examiner has persisted in his rejection of the claims under 35 USC §103(a) based on Drent 3 (USP 6,737,542), Drent 2 (USP 5,304,674), Drent 1 (WO 02/26690) and Sielcken et al (USP 5,304,674).

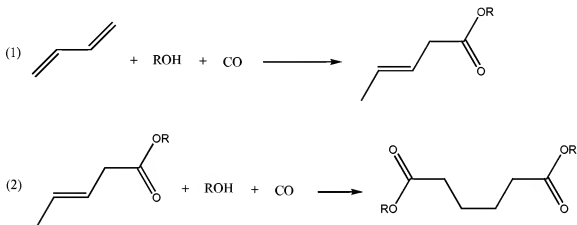
In essence, the Examiner seems to be of the opinion that Drent 2 discloses a "mixture" of ligands in a process for the carbonylation of a 1,3-butadiene. The Examiner then concludes that reference to such a "mixture" means the use of two or more of the phosphorous ligands disclosed therein. As will become evident from the discussion which follows, the Examiner's interpretation of the applied reference publications is factually in error which has in turn given rise to a legally erroneous conclusion of "obviousness" under 35 USC §103(a).

In response to the Examiner's assertions, there is submitted herewith a Factual Declaration of Otto Erik Sielcken, a named coinventor of the subject matter disclosed and claimed herein. Inventor Sielcken's comments are further summarized below.

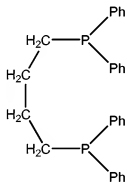
One aspect of the invention disclosed and claimed in the above-identified US application is the surprising discovery that a 1,3-butadiene carbonylation process with high selectivity to monoesters can be achieved while yet providing a catalyst system with high stability. Thus, according to the processes of the invention disclosed and claimed in the above-identified US application, the Pd and P inventories in the catalyst system employed may be maintained at very high levels, e.g., 98% or more (See Examples 1-3 of the subject application).

Applicants note that, contrary to what the presently claimed invention achieves, the various Drent references cited by the Examiner, especially Drent 3, aim to convert butadiene into **diesters**, namely adipates, in such a way that the highest selectivity to the **linear** adipate is achieved (with by-products of the Drent processes being branched glutarate and succinate). Drent's results can be expressed in terms of "linearity" which

are for convenience of understanding the reaction sequences can be represented by the following reaction schemes:



It can be seen from Drent 2 that the catalysts with a C4 bridged BDPbut ligand will carbonylate butadiene into the **monoester** (alkenoate ester) with high selectivity (i.e., a selectivity of 87% and higher). The structure of BDPbut is shown in the following:

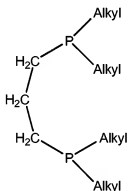


BDPbut

Substantially no adipate esters (i.e. diesters) are formed at all when only the C4 bridged BDPbut ligand is employed. (See comparative Example A of Drent 2.) However, there is also no teaching in Drent 2 as to catalyst stability is presented, and as

evidenced in the present application, catalyst stability is insufficient. Drent's aim of production of adipate cannot therefore be achieved by using BDPbut as sole catalyst.

In order to address this issue, Drent therefore employs a second ligand having a C3 bridge and **alkyl** substituents in order to ensure that the reaction (see reaction scheme (2) above) proceeds to form the adipate from the monoester. Such C3 bridged ligands are presented by the following formula:



The first catalytic species of the Drent references, i.e., the C4 bridged ligand, thus converts butadiene into the monoester, and the second catalytic species, i.e., the C3 bridged ligand, converts the monoester into the adipate. Moreover, while both catalysts (ligands) used in the Drent references have a catalytic function, there is no teaching or suggestion of the combination of ligands having a stabilizing function on palladium.

Therefore, while the Drent references indeed disclose that "mixtures" of two catalytic species are present, they are not "mixtures" which achieve an alkylpentenoate reaction product – i.e., a monoester carbonylation product from butadiene. Instead, the aim of the Drent references is to convert butadiene into **diesters**, namely adipates, in such a way that the highest selectivity to the **linear** adipate is achieved.

Furthermore, while there are quite a number of Drent patent publications of record herein describing that BDPbut is a good ligand for catalysis towards monoester

formation there is however not one example in any of the Drent patent publications that describes a C<sub>3</sub> ligand with alkyl groups as useful for such reaction.

Therefore, based on the comments above, and the rationale expressed in the applicants' prior Amendment 3 dated August 27, 2009 (which rationale is expressly incorporated hereinto by reference as if set forth fully herein), it is indeed quite novel and patentably unobvious to employ a process ligand and a second phosphine ligand as defined by the presently pending claims for the carbonylation of 1,3-butadiene to produce alkylpentenoate – i.e., a monoester carbonylation product from 1,3-butadiene.

Withdrawal of the rejection advanced under 35 USC §103(a) is therefore solicited.

## 5. Fee Authorization

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140.

Respectfully submitted,

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